

## Changes in incidence of and mortality from breast cancer in England and Wales since introduction of screening

Mike Quinn, Elizabeth Allen on behalf of the United Kingdom Association of Cancer Registries

### Abstract

**Objective**—To assess the impact of the NHS breast screening programme on the incidence of and mortality from breast cancer.

**Design**—Comparison of age specific incidence and mortality before and after the introduction of screening in the late 1980s.

**Setting**—England and Wales.

**Subjects**—Women aged over 30 years.

**Results**—In 1992 the age standardised incidence of breast cancer was 40% higher than in 1979. After the introduction of screening in 1988 recorded incidence rates rose steeply in the screened age group (50–64 year olds) but not in others. In 1992 the rates levelled off at about 25% higher than in 1987. Total mortality from breast cancer has increased steadily since the 1950s; the rates increased earlier in the younger age groups. By the mid-1980s rates had begun to fall in the younger age groups; but total mortality was still among the highest in the world. Age standardised mortality in the 55–69 age group changed little during the first three years of screening but then fell steeply and in 1994 was 12% lower than in 1987.

**Conclusions**—Since the introduction of screening there have been pronounced increases in recorded incidence in the screened age group. Cancer registries have an essential role in assessing screening programmes and cancer services. The steep decrease in mortality in 55–69 year olds which began three years after screening started is unlikely to be due to screening. The widespread adoption of treatment with tamoxifen during this period may be important. With the reduction in mortality already observed and the expected additional benefits from screening, the *Health of the Nation* target should be achieved.

### Introduction

Breast cancer is the most common cancer in women worldwide, accounting for almost 20% of all malignancies. Over half a million women develop breast cancer every year.<sup>1</sup> Breast cancer has an enormous impact on the individual patient, and it often strikes in the prime of life. There is no proved method of primary prevention. Treatment may be physically disfiguring and emotionally disruptive. Breast cancer has an unpredictable course and the risk of metastases continues for 20 years or more. When breast cancer results in death this is often after a prolonged, painful, and disabling period of disease.

The incidence of and mortality from breast cancer vary greatly around the world. In the late 1980s mortality in Britain was not only higher than in most other countries in western Europe, it was among the highest in the world.<sup>2</sup> Incidence in Britain, however, was similar to that in other western European countries.

Incidence has been rising in many parts of the world, including the United States, Canada, Europe, the Nordic countries, Singapore, and Japan, where the rates are the lowest in the world.<sup>2</sup> Much of this rise may have resulted from increased diagnostic activity, and will accelerate with the introduction of screening.

The corollary of high mortality coupled with average incidence in Britain is that survival is worse than elsewhere in Europe. This has recently been supported by the Eurocare study, which included data from 30 cancer registries in 12 countries.<sup>3</sup> England and Scotland, with five year relative survival (standardised for age) of just over 60%, ranked 8th equal and 10th, respectively. Survival does not seem to have improved much in England since the late 1970s.<sup>3,5</sup> Survival is much poorer for later stage disease: five year relative survival rates are 20% for stage IV at presentation compared with about 85% for stage I.<sup>6,7</sup>

Most of the known risk factors relate to a woman's reproductive history, and endogenous hormones, particularly oestrogen, probably have an important role in the development of breast cancer.<sup>8</sup> None of these risk factors is currently amenable to primary prevention.<sup>9</sup> The incidence observed in second and subsequent generations of Japanese women who migrated to the United States is similar to that of their host population, suggesting that international differences in incidence between countries are social and environmental rather than genetic in origin. Only about 5% of breast cancer is due to highly penetrant dominant genes.<sup>10</sup>

With this background, and the information then available from trials of screening outside Britain, in 1986 the working group chaired by Forrest recommended that mass population screening for breast cancer of 50–64 year old women in the United Kingdom should be introduced with single mediolateral oblique view mammography and a three year interval between screens.<sup>11</sup> The NHS breast screening programme began operation in 1988. Screening methods varied around the country: in some screening units an additional, craniocaudal mammogram was taken; in some units the x ray films were read by more than one person; and in a few areas the screening interval was two years. The prevalence round was not completed everywhere by the target date of March 1993.<sup>12,13</sup>

To assess the impact of the screening programme we compared the age specific incidence of breast cancer in women in England and Wales from 1979 to 1987 with that for 1988 to 1992. We also examined the age specific mortality from breast cancer in women in England and Wales from 1950 to 1994.

### Subjects and methods

Cancers are registered in England and Wales by 12 independent regional registries which collect data on neoplasms occurring in people either resident or treated in their regions. In England each of the 14

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BMJ 1995;311:1391-5

regional health authority areas which existed until April 1994 was covered by its own cancer registry, except that all four Thames authorities were covered by one registry. The Welsh Office is responsible for registering patients resident in Wales. National data have been collated since 1947 by the General Register Office and its successor, the Office of Population Censuses and Surveys. A fuller description of the system has been given elsewhere.<sup>14</sup> A similar system of cancer registration exists in Scotland based on five regional registries and coordinated by the Information and Statistics Division of the NHS Common Services Agency in Edinburgh. Both the ascertainment and quality of data from cancer registries in Britain are generally high.<sup>15 16</sup>

Incidence data shown here for breast cancer in women in England and Wales from 1979 to 1989 are based on records of individual cases submitted to and validated by the Office of Population Censuses and Surveys.<sup>17</sup> Figures for 1990, 1991, and 1992 are based on additional data supplied by the regional cancer registries that had been validated by the registries and aggregated into five year age groups. A pilot exercise covering registrations for all cancer sites for 1989 confirmed that there were only small differences between the two types of data. For the three regions for which data were not available for 1992, it was assumed that the age specific incidence rates changed (compared with 1991) by the same amount as the average change in those regions for which data were available. Small allowances (of about 10%) were made for recognised incompleteness of data for two other regions.

We used published data on mortality by cause of death for 1950 to 1994. In 1984 the Office of Population Censuses and Surveys, which administers the registration of births, marriages, and deaths in England and Wales, introduced a revised interpretation of the World Health Organisation's Rule 3, which governs how information in the two parts of the death certificate is used to determine the underlying cause of death. Consequently, deaths from causes such as pneumonia declined steeply in 1984, whereas deaths from causes often mentioned in part II of the certificate increased.<sup>18</sup> The effect on mortality from breast cancer in women under 75 was an increase of just over one percentage point. For deaths from 1993 onwards, Rule 3 has been interpreted as it had been before 1984.<sup>19</sup> Before 1993, if the information provided on death certificates was unclear, the Office of Population Censuses and Surveys sent letters to the certifiers asking for further information to help assign an underlying cause of death. This procedure reduced the numbers of deaths from non-specific causes. The effect was to increase mortality from breast cancer by about one half of one percentage point. From 1993 no further information has been sought from certifiers, although this procedure may be reintroduced in 1998.<sup>19</sup> We adjusted the mortality data to allow for these procedural changes.

The current *Health of the Nation* target for breast cancer is a 25% reduction in mortality by the year 2000 in women aged 50-69.<sup>20 21</sup> The average five year relative survival rate for breast cancer in England and Wales is between 60% and 65%,<sup>22</sup> and the median survival is more than eight years. The evaluation group of the NHS breast screening programme therefore recommended that, until it is feasible to perform cohort analyses of mortality in screened women, the most useful outcome measure of mortality with which to assess the effects of screening is age standardised mortality in women aged 55-69.<sup>23</sup> This is the measure we have examined.

The age specific rates for both incidence and mortality for each year were calculated as the numbers of cases divided by the estimated mid-year population.<sup>24</sup> The summary rates for incidence and mortality were

directly age standardised with the European standard population.

## Results

### INCIDENCE

In 1992 the recorded age standardised incidence of breast cancer in women in England and Wales was 102 per 100 000, about 40% higher than the rate in 1979 (74 per 100 000) (fig 1). From 1979 to 1987—before population screening was introduced—the rate increased on average by about 2% each year to 86 per 100 000. From 1988 to 1991 the annual rate of increase more than doubled to nearly 4.5%; there was virtually no change in 1992 compared with 1991.

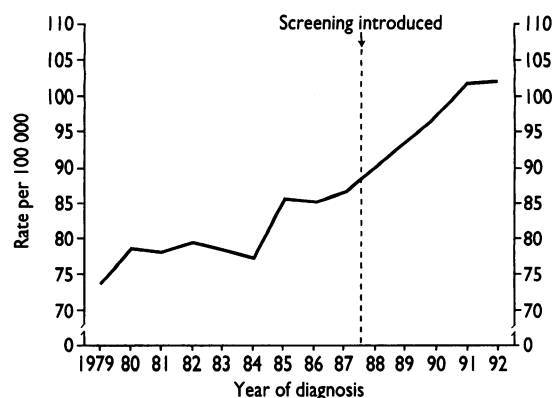


FIG 1—Age standardised incidence of breast cancer, England and Wales, 1979-92

The recorded age specific incidence shows steep increases since 1987 in the screened age groups (50-54, 55-59, and 60-64 years) (fig 2). In 1991 and 1992 incidence in the screened group was 25% higher than in 1987. By 1991 the incidence in 50-54 year olds had risen to be almost as high as in 65-69 year olds, and that in 55-59 year olds had risen to the rates in 70-74 and 75-79 year olds. As early as 1990, incidence in 60-64 year olds actually exceeded that in 80-84 year olds. Incidence after 1987 increased slightly in 65-69 year olds (and in 1990 just exceeded the rate in 70-74 year olds); but in all the other age groups not invited for screening, incidence fluctuated only slightly from year to year.

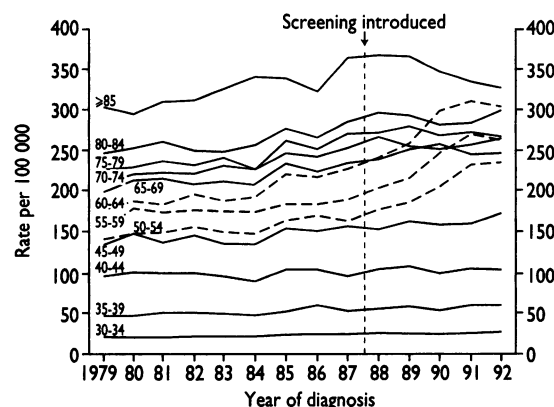


FIG 2—Age specific incidence of breast cancer, England and Wales, 1979-92

### MORTALITY

Total mortality from breast cancer has increased steadily since the 1950s. The rise in mortality in those aged under 65 seems to have started in the early 1960s, whereas increases in older women began only in the 1970s (fig 3). By the mid-1980s, mortality had begun to fall in women aged under 50 but was still rising in those over 60.

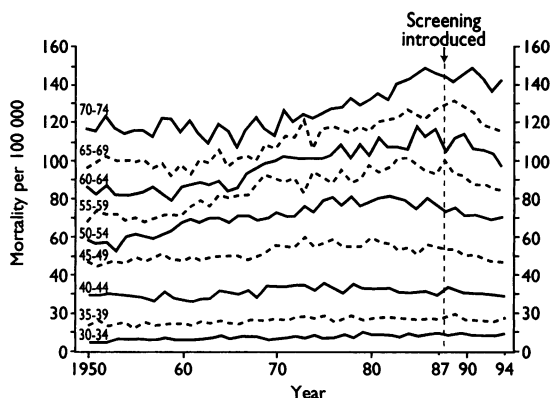


FIG 3—Age specific mortality from breast cancer, England and Wales, 1950-94

Age standardised mortality in the age range 55-69 was stable in the 1950s then rose steeply from about 83 per 100 000 population in the early 1960s to level off at around 107 per 100 000 in the mid-1980s (fig 4). Mortality changed little during the late 1980s but fell steeply after 1990 and in 1994 was 12% lower than in 1987.

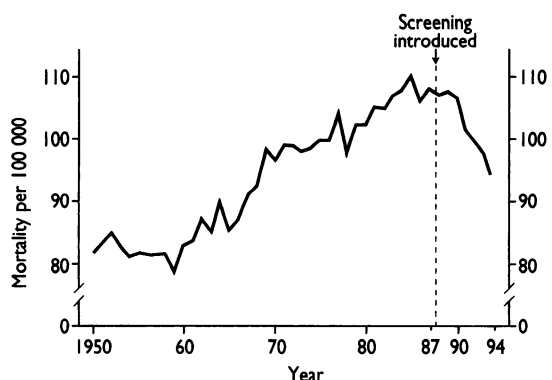


FIG 4—Age standardised mortality from breast cancer in women aged 55-69, England and Wales, 1950-94

## Discussion

Few screening programmes satisfy all the criteria laid down by the World Health Organisation.<sup>25</sup> Screening for breast cancer by mammography, however, meets most of the criteria: breast cancer is an important health problem; there is a recognisable early stage; mammography is a suitable screening method which seems to be acceptable to women<sup>26</sup>; facilities for diagnosing and treating abnormalities are of a sufficiently high standard; and the chance of harm is considerably smaller than the chance of benefit.<sup>11 27</sup> The natural course of the disease, however, is still not well understood. It is possible that if the treatment given at an early stage is not more effective than after diagnosis of symptomatic disease, detection at an early stage may lead to an apparent improvement in survival because of lead time bias without any real reduction in mortality.<sup>11</sup> The results from randomised screening trials, however, indicate that early diagnosis and treatment is beneficial.<sup>28</sup>

Had screening been introduced simultaneously throughout the country in 1988 the prevalence round would have taken three years (the planned interval between screens) to complete, but some screening units were not opened until 1992.<sup>13</sup> The figures for 1988 to 1992 clearly show the increases in the recorded incidence of breast cancer that were expected in the screened group during the extended prevalence round.<sup>11 29</sup> The impact of the screening programme has also been shown by increases in the proportions of tumours that were small or had not spread to the axilla,<sup>6 7 30-32</sup> as has been found elsewhere.<sup>33-40</sup> Recorded

incidence from 1994 onwards, after completion of the prevalence round, is expected to return to prescreening levels (except for women aged 50 to 52, who will always be undergoing prevalence screening).

The results presented in this paper and elsewhere<sup>37 41-43</sup> demonstrate the essential role of cancer registries in evaluating the effects of screening for breast cancer. Registries monitor incidence in all age groups. The registration of all breast cancers, not just those in screened women, enables the assessment—in close collaboration with regional quality assurance teams for the NHS breast screening programme—of the extent of interval cancers. In addition, only cancer registries can provide unbiased, population based estimates of survival. Their data greatly facilitate the examination of variations in the provision of cancer services and of alleged clusters of cancer,<sup>44 45</sup> and over one million people in cohort studies are “flagged” for cancer at the NHS Central Register.<sup>46</sup> Registries depend heavily, however, on hospitals, pathology laboratories, and general practitioners for timely and accurate data.

Mortality in women aged under 55 had started to fall—and the earlier upward trends in those aged 55-59 and 60-64 seemed to have levelled off—before 1988, when the prevalence round of screening started. The age specific results for mortality show that the upward trends appeared first in the mid-1950s in women aged 50 to 54 years, and then at approximately five year intervals for each successive age group. The reversal of the trends began first in the younger women (fig 3). These patterns suggest a cohort effect. Analyses with age period cohort models have indicated increasing mortality by year of birth from 1900 to about 1930.<sup>2</sup> The trends for breast cancer contrast sharply with that for age standardised mortality in women from all causes, which has declined steadily over a long period and fell 18% between 1980 and 1994.<sup>47</sup>

The lower survival from breast cancer in Britain in the early 1980s compared with elsewhere in Europe may be attributable to the wide variations in treatment.<sup>48 49</sup> Although the King's Fund published guidelines for treatment in 1986,<sup>50</sup> there was still a lack of consensus on management with surgery, radiotherapy, and chemotherapy among clinicians in southeast England in 1990.<sup>41</sup> In Yorkshire, patients of surgeons who treated more than 30 new cases each year and whose rates of use of chemotherapy and hormone therapy were higher had better survival.<sup>42</sup> Deprivation may also have an impact on survival, independent of stage at presentation,<sup>43 51</sup> although the explanation for this is unclear.

None of the screening trials showed any reduction in mortality either during or immediately after the prevalence round; any decline in mortality may take about seven years to appear.<sup>29 38 40 52-54</sup> The observed reduction in mortality in England and Wales is therefore unlikely to be the result of screening.

## ADJUVANT TAMOXIFEN

Although the first evidence of the effectiveness of tamoxifen appeared in 1983,<sup>55</sup> conclusive evidence was not published until 1992.<sup>56</sup> In 1986 the King's Fund issued guidelines recommending the use of tamoxifen in women aged over 50.<sup>50</sup> In the Edinburgh trial the use of tamoxifen rose from 36% in the early 1980s to 79% in the late 1980s<sup>52</sup>; a similar rise was noted in Yorkshire.<sup>7</sup> As early as 1990 nearly all breast cancer patients aged 50 or over in southeast England were being treated with tamoxifen.<sup>41</sup> The widespread adoption of tamoxifen treatment may have influenced recent mortality in women aged over 50. There does not, however, seem to have been any clear reduction in mortality in premenopausal women (fig 3).

Other possible explanations for the observed

## Key messages

- Breast cancer is a major public health problem and is not amenable to primary prevention
- After the introduction of screening in 1988, recorded incidence in the screened age group (50-64 years) rose by about 25% but changed little in other age groups
- Cancer registries have an essential role in the evaluation of screening programmes and cancer services
- Mortality in the 55-69 age group, which showed an upward trend prior to screening, levelled off and then fell steeply after 1990
- The reduction in mortality is unlikely to be due to screening, but the widespread adoption of treatment with tamoxifen in the late 1980s may be important
- Further falls in mortality are expected

reduction in mortality, including changing patterns of childbearing after the second world war, use of oral contraceptives, and earlier diagnosis and treatment, have been discussed by Beral *et al*<sup>57,58</sup> and dos Santos Silva and Swerdlow.<sup>59</sup>

There has recently been vigorous clinical and public debate about whether women with breast cancer are all being offered optimal care by the NHS.<sup>50,60,61</sup> The issues have been addressed by the Chief Medical Officers' Expert Advisory Group on Cancer. It recommended that a new structure for cancer services should be based on a network of skill in cancer care involving primary care, cancer units in district hospitals, and specialised cancer centres. The network is intended to deliver a uniform standard of high quality care to all patients.<sup>62</sup>

### FUTURE TRENDS IN MORTALITY

Mortality from breast cancer has fallen. It will, however, be extremely difficult to estimate what proportions of any future falls in mortality are due to further gains from treatment with tamoxifen, better management of cases at the new cancer centres, continuation of any cohort effect, changes in major risk factors, or screening. On the basis of results from the Swedish two county study,<sup>38</sup> and assuming 70% acceptance of invitation to screening, a reduction in mortality of about 25% can be expected.<sup>20</sup> The NHS breast screening programme has continued to meet its target rates for uptake, recall, biopsy, benign biopsy, and detection of cancer,<sup>12,13,30</sup> some of which were tightened during 1993 in the light of experience.<sup>13</sup> Trials of different screening intervals are currently in progress. But evidence of the higher than expected rates of interval cancers<sup>63</sup> indicates that the caution about the interval between screens expressed in the Forrest report<sup>11</sup> was justified and that unless it is reduced from three to two years the reduction in mortality attributable to screening may be less than 25%. We would nevertheless expect that, with the reduction already observed and the accrual of benefits from screening, the *Health of the Nation* target should be met.<sup>20</sup>

### United Kingdom Association of Cancer Registries

Member registries (directors) are: East Anglian (Dr C H Brown, Dr T W Davies), East Scotland (Dr S N Das), Information and Statistics Division of the NHS in Scotland (Dr D Brewster, Dr C S Muir), Merseyside and Cheshire (Dr E M I Williams), North East Scotland (Dr N R Waugh),

North Scotland (Dr M H Elia), North Western (Ms S Wilson, Professor C B J Woodman), Northern (Mr J Stevenson), Northern Ireland (Dr A Gavin), Office of Population Censuses and Surveys (Dr M J Quinn), Oxford (Dr M Roche), South East Scotland (Dr S Parker), South Western (Dr D F H Pheby), Thames (Professor M P Coleman), Trent (Professor C E D Chilvers), Wales (Dr M Cotter, Mr R Kilpatrick), Wessex (Dr J A E Smith), West of Scotland (Dr C R Gillis), West Midlands (Professor R K Griffiths), Dr G M Lawrence), Yorkshire (Professor D Forman, Professor C A Joslin).

We thank Julietta Patnick, Liz Roberts, and Jan Warner of the English, Welsh, and Scottish NHS breast screening programmes, and our colleagues Tim Devis, Karen Dunnell, and John Fox at the Office of Population Censuses and Surveys, for advice on drafts of this paper.

Funding: No special funding.

Conflict of interest: None.

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- 1 Parkin DM, Laara E, Muir CS. Estimates of the worldwide frequency of sixteen cancers in 1980. *Int J Cancer* 1988;41:184-97.
- 2 Coleman MP, Estève J, Damiacki P, Arslan A, Renard H. *Trends in cancer incidence and mortality*. Lyons: International Agency for Research on Cancer, 1993. (IARC scientific publication No 121.)
- 3 Berrino F, Sant M, Verdecchia A, Capocaccia R, Hakulinen T, Estève J, eds. *Survival of cancer patients in Europe. The EURO-CARE Study*. Lyons: International Agency for Research on Cancer, 1995. (IARC scientific publication No 132.)
- 4 Merseyside and Cheshire Cancer Registry. *Breast cancer bulletin: stimulating the debate*. Liverpool: Merseyside and Cheshire Cancer Registry, 1994.
- 5 Wessex Cancer Intelligence Unit. *Trends in cancer survival in Wessex, 1973 to 1990*. Winchester: Wessex CIU, 1994.
- 6 Thames Cancer Registry. *Cancer in south east England, 1991*. London: Thames Cancer Registry, 1994.
- 7 Yorkshire Cancer Organisation. *Cancer in Yorkshire. Cancer registry report series, 3, breast cancer*. Leeds: YCO, 1995.
- 8 McPherson K, Steel CM, Dixon JM. Breast cancer—epidemiology, risk factors, and genetics. *BMJ* 1994;309:1003-7.
- 9 Baum M, Ziv Y, Colletta AA. Can we prevent breast cancer? *Br J Cancer* 1991;64:205-7.
- 10 Evans DGR, Fentiman IS, McPherson K, Asbury D, Ponder BAJ, Howell A. Familial breast cancer. *BMJ* 1994;308:183-7.
- 11 Department of Health and Social Security. *Breast cancer screening: report to the health ministers of England, Wales, Scotland and Northern Ireland*. London: HMSO, 1986. (Forrest report.)
- 12 Patnick J, ed. *NHS breast screening programme: review 1993*. Sheffield: NHS Breast Screening Programme, 1993.
- 13 Patnick J, ed. *NHS breast screening programme: review 1994*. Sheffield: NHS Breast Screening Programme, 1994.
- 14 Office of Population Censuses and Surveys. *Cancer statistics—registrations, England and Wales, 1989*. London: HMSO, 1994. (Series MB1 No 22.)
- 15 Brewster D, Crichton J, Muir C. *Accuracy of 1990 cancer registration data in Scotland*. Edinburgh: Scottish Cancer Intelligence Unit, 1994.
- 16 Seddon D, Williams EMI. *Accuracy in population based cancer registration: an assessment in the Mersey Regional Cancer Registry*. Liverpool: Mersey Regional Cancer Registry, 1994.
- 17 Office of Population Censuses and Surveys. *Cancer statistics—registrations, England and Wales, 1979 to 1989*. London: HMSO, 1983 to 1994. (Series MB1 No 11-16, 18-22.)
- 18 Office of Population Censuses and Surveys. *Mortality statistics—cause, England and Wales, 1984*. London: HMSO, 1985. (Series DH2 No 11.)
- 19 Office of Population Censuses and Surveys. *Mortality statistics—cause, England and Wales, 1993*. London: HMSO, 1995. (Series DH2 No 20.)
- 20 Department of Health. *The health of the nation. Key area handbook: cancers*. London: DoH, 1993.
- 21 NHS Breast Screening Programme. *Evidence and experience since the Forrest report*. Sheffield: NHS BSP, 1991.
- 22 Office of Population Censuses and Surveys. *Cancer survival 1981 registrations*. London: OPCS, 1994. (Monitor MB1 88/1.)
- 23 NHS Breast Screening Programme Evaluation Group. *Outcome objectives*. Sheffield: NHS BSP, 1995.
- 24 Office of Population Censuses and Surveys. *Key population and vital statistics—local and health authority areas, 1992*. London: HMSO, 1994. (Series VS No 19, PP1 No 15.)
- 25 Wilson JMG, Jungner G. *Principles and practice of screening for disease*. Geneva: World Health Organisation, 1968. (WHO Public Health Paper 34.)
- 26 Scottish Breast Screening Programme. *Users' views: a report of a survey of women's views of the Scottish breast screening service*. Edinburgh: Scottish BSP, 1992.
- 27 Law J. The radiation dose factor. *Proceedings of the Fourth International Conference on Breast Cancer Screening*, Cambridge. London: Marie Curie Cancer Care, 1995.
- 28 Day NE. Screening for breast cancer. *Br Med Bull* 1991;47:400-15.
- 29 Andersson I, Aspergren K, Janzon L, Landberg T, Lindholm K, Linnell F, et al. Mammographic screening and mortality from breast cancer: the Malmö mammographic screening trial. *BMJ* 1988;297:943-8.
- 30 Chamberlain J, Moss SM, Kirkpatrick AE, Michell M, Johns L. NHS breast screening results for 1991-2. *BMJ* 1993;307:353-6.
- 31 Crisp WJ, Higgs MJ, Cowan WJ, Cunliffe WJ, Liston J, Lunt LG, et al. Screening for breast cancer detects tumours at an earlier biological stage. *Br J Surg* 1993;80:863-5.
- 32 Moody C, Corder A, Mullee MA, Guyer P, Rubin C, Cross M, et al. The impact of the first three years of breast cancer screening on the overall presentation of breast cancer. *J R Soc Med* 1994;87:259-62.
- 33 Anderson TJ, Lamb J, Donnan P, Alexander FE, Huggins A, Muir BB, et al. Comparative pathology of breast cancer in a randomised trial of screening. *Br J Cancer* 1991;64:108-13.
- 34 Frisell J, Eklund L, Hellström L, Lidbrink E, Rutqvist L-E, Somell A.

- Randomized study of mammography screening—preliminary report on mortality in the Stockholm trial. *Breast Cancer Res Treat* 1991;18:49-56.
- 35 Klemi PJ, Joensuu H, Toikkanen S, Tuominen J, Räsänen O, Tyyrkö J, *et al*. Aggressiveness of breast cancers found with and without screening. *BMJ* 1992;304:467-9.
  - 36 Miller BA, Feuer EJ, Hankey BF. Record incidence trends for breast cancer in women and the relevance of early detection: an update. *CA Cancer J Clin* 1993;43:27-41.
  - 37 Robertson FM, Romanow J, Otchy DP, Walters MJ. Effect of mass screening mammography on staging of carcinoma of the breast in women. *Surg Gynecol Obstet* 1990;171:55-8.
  - 38 Tabár L, Fagerberg G, Duffy SW, Day NE, Gad A, Grönroth O. Update of the Swedish two-county program of mammographic screening for breast cancer. *Radio Clin North Am* 1992;30:187-210.
  - 39 UK Trial of Early Detection of Breast Cancer Group. Breast cancer mortality after 10 years in the UK trial of early detection of breast cancer. *The Breast* 1993;2:13-20.
  - 40 Chu KC, Smart CR, Tarone RE. Analysis of breast cancer mortality and stage distribution by age for the Health Insurance Plan clinical trial. *J Natl Cancer Inst* 1988;80:1125-31.
  - 41 Chouillet AM, Bell, CMJ, Hiscox JG. Management of breast cancer in southeast England. *BMJ* 1994;308:168-71.
  - 42 Sainsbury R, Haward B, Rider L, Johnston C, Round C. Influence of clinician workload and patterns of treatment on survival from breast cancer. *Lancet* 1995;345:1265-70.
  - 43 Schrijvers CTM, Mackenbach JP, Quinn MJ, Coleman MP. Deprivation and survival from breast cancer. *Br J Cancer* 1995;72:738-43.
  - 44 Elliott P, Westlake AJ, Hills M, Kleinschmidt I, Rodrigues L, McGale P, *et al*. The small area health statistics unit: a national facility for investigating health around point sources of environmental pollution in the United Kingdom. *J Epidemiol Community Health* 1992;46:345-9.
  - 45 Elliott P, Hills M, Beresford J, Kleinschmidt I, Jolley D, Pattenden S, *et al*. Incidence of cancers of the larynx and lung near incinerators of waste solvents and oils in Great Britain. *Lancet* 1992;339:854-8.
  - 46 Office of Population Censuses and Surveys. *Medical research services*. London: OPCS, 1993.
  - 47 Office of Population Censuses and Surveys. *Updates*. London: OPCS, 1995. (No 6, June.)
  - 48 Basnett I, Gill M, Tobias J. Variations in breast cancer management between a teaching and a non-teaching district. *Eur J Cancer* 1992;28:1945-59.
  - 49 McCarthy M, Bore J. Treatment of breast cancer in two teaching hospitals: a comparison with consensus guidelines. *Eur J Cancer* 1991;27:579-82.
  - 50 King's Fund. Consensus development conference: treatment of primary breast cancer. *BMJ* 1986;293:946-7.
  - 51 Carnon AG, Ssemwogerere A, Lamont DW, Hole DJ, Mallon EA, George WD, *et al*. Relation between socioeconomic deprivation and pathological prognostic factors in women with breast cancer. *BMJ* 1994;309:1054-7.
  - 52 Alexander FE, Anderson TJ, Brown HK, Forrest APM, Hepburn W, Kirkpatrick AE, *et al*. The Edinburgh randomised trial of breast cancer screening: results after 10 years of follow-up. *Br J Cancer* 1994;70:542-8.
  - 53 Shapiro S, Venet W, Strax P, Venet L. *Periodic screening for breast cancer. The Health Insurance Plan project and its sequelae, 1983-1986*. Baltimore: Johns Hopkins University Press, 1988.
  - 54 Verbeek ALM, Hendricks JHCL, Holland R, Mravunac M, Sturms F, Day NE. Reduction of breast cancer mortality through mass screening with modern mammography. First results of the Nijmegen project, 1975-1981. *Lancet* 1984;i:1222-4.
  - 55 Nolvadex Adjuvant Trial Organisation. Controlled trial of tamoxifen as adjuvant agent in management of early breast cancer. *Lancet* 1983;i:257-61.
  - 56 Early Breast Cancer Trialists' Collaborative Group. Systemic treatment of early breast cancer by hormonal, cytotoxic or immune therapy. *Lancet* 1992;339:1-15, 71-85.
  - 57 Beral V, Hermon C, Reeves G, Peto R. Sudden fall in breast cancer death rates in England and Wales. *Lancet* 1995;345:1642-3.
  - 58 Beral V, Hermon C, Reeves G, Key T. Breast cancer trends in women in Sweden, the UK and the USA in relation to their past use of oral contraceptives. *Proceedings of the Second International Symposium Hormonal Carcinogenesis*. Berlin: Springer Verlag (in press).
  - 59 dos Santos Silva I, Swerdlow AJ. Recent trends in incidence of and mortality from breast, ovarian and endometrial cancers in England and Wales and their relation to changing fertility and oral contraceptive use. *Br J Cancer* 1995;72:485-92.
  - 60 Kearsley JH. Cytotoxic chemotherapy for common adult malignancies: "the emperor's new clothes" revisited? *BMJ* 1986;293:871-6.
  - 61 Sikora K. Enraged about radiotherapy. *BMJ* 1994;308:188-9.
  - 62 Department of Health and Welsh Office. *A policy framework for commissioning cancer services: a report by the Chief Medical Officers of England and Wales*. London: DoH, 1995.
  - 63 Woodman CBJ, Threlfall AG, Boggis CRM, Prior P. Is the three year breast screening interval too long? Occurrence of interval cancers in NHS breast screening programme's north western region. *BMJ* 1995;310:224-6.

(Accepted 20 September 1995)

## Patients who reattend after head injury: a high risk group

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### Abstract

**Objective**—To assess risk factors for important neurosurgical effects in patients who reattend after head injury.

**Design**—Retrospective study.

**Subjects**—606 patients who reattended a trauma unit after minor head injury.

**Main outcome measures**—Intracranial abnormality detected on computed tomography or the need for neurosurgical intervention.

**Results**—Five patients died: two from unrelated causes and three from raised intracranial pressure. On multiple regression analysis the only significant predictor for both abnormality on computed tomography (14.4% of reattenders) and the need for operation (5% of reattenders) was vault fracture seen on the skull radiograph ( $P < 10^{-6}$ ); predictors for abnormal computed tomogram were a Glasgow coma scale score  $< 15$  at either first or second attendance ( $P < 0.0001$ ) and convulsion at second attendance ( $P < 0.05$ ); predictive for operation only was penetrating injury of the skull ( $P < 10^{-6}$ ). On contingency table analysis these associations were confirmed. In addition significant associations with both abnormality on computed tomography and operation were focal neurological abnormality, weakness, or speech disturbance. Amnesia or loss of consciousness at the time of initial injury, personality change, and seizures were significantly associated only with abnormality on computed tomography. Headache, dizziness, nausea, and vomiting were common in reattenders but were found to have no independent significance.

**Conclusions**—All patients who reattend after head injury should undergo computed tomography as at least 14% of scans can be expected to yield positive results. Where this facility is not available patients

with predictors for operation should be urgently referred for neurosurgical opinion. Other patients can be readmitted and need referral only if symptoms persist despite symptomatic treatment or there is neurological deterioration while under observation. These patients are a high risk group and should be treated seriously.

### Introduction

The post-concussion syndrome of headache, dizziness, and various other non-specific symptoms is common after head injury and has been estimated to persist for at least two months in up to 57% of patients.<sup>1</sup> Less common, but of greater concern to most doctors in emergency facilities, is the occurrence of a delayed extradural haematoma or subdural haematoma. In our unit, as in many others, patients sent home after a head injury are always provided with an advice sheet on head injury instructing them to return should they develop symptoms suggestive of intracranial problems, such as severe headache, vomiting, convulsions, weakness, or abnormal drowsiness. Common sense suggests that patients who reattend are probably a high risk group, as symptoms are clearly not abating as expected with the passage of time. There has been little published on whether this is indeed so.

We examined retrospectively our experience of patients with head injury who return to hospital to establish the incidence of neurosurgically important lesions associated with various clinical features.

### Patients and methods

Details of patients attending the trauma unit at Groote Schuur Hospital in Cape Town are recorded in the trauma unit register. All patients are over the age of

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BMJ 1995;311:1395-8